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(54) **SCROLL COMPRESSOR HAVING VACUUM PREVENTING STRUCTURE**

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F03C 2/00 (2006.01)
F04C 18/00 (2006.01)

(52) **U.S. Cl.** **418/55.5**; 418/57; 418/55.1; 417/308; 417/310

(58) **Field of Classification Search** 418/55.1–55.5, 418/57; 417/308, 310; 137/538
See application file for complete search history.

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(57) **ABSTRACT**

A scroll compressor having a vacuum preventing structure includes: a casing forming a receiving space therein; a fixed scroll fixed to a main frame installed in the casing, and including a back pressure passage at an outer side surface thereof, a discharge pressure hole formed at one side of the back pressure passage such that the back pressure passage and a discharge pressure space of the casing can communicate with each other, a middle pressure hole formed at another side of the back pressure passage such that the back pressure passage and a compression space of the casing can communicate with each other, and a suction pressure hole formed at still another side of the back pressure passage such that the back pressure passage and a suction pressure space can communicate with each other; an orbiting scroll positioned between the fixed scroll and the main frame and forming a compression space by being coupled with the fixed scroll; a piston slidably installed in the back pressure passage, for opening or closing the discharge pressure hole; an elastic member installed in the back pressure passage, for supporting the piston; and a stopper for closing an inlet of the back pressure passage.

17 Claims, 5 Drawing Sheets

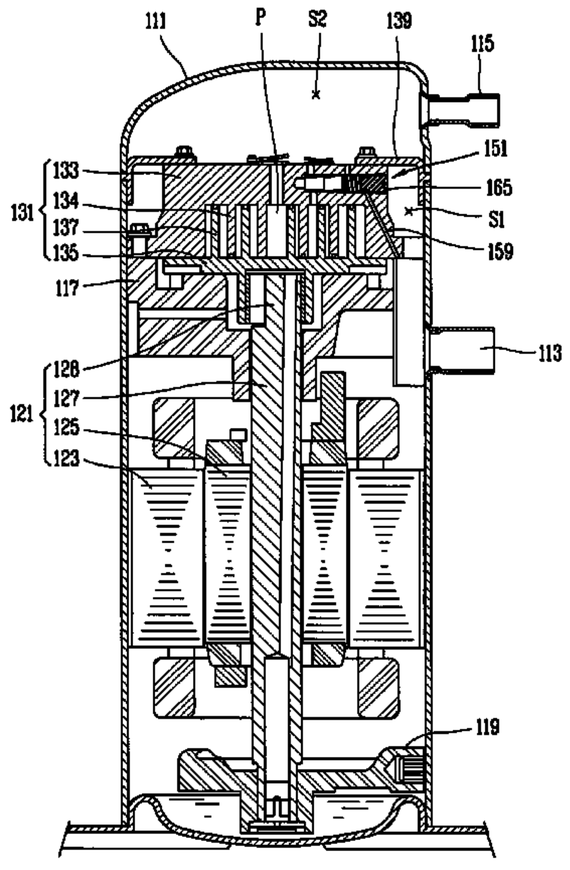


FIG. 1
CONVENTIONAL ART

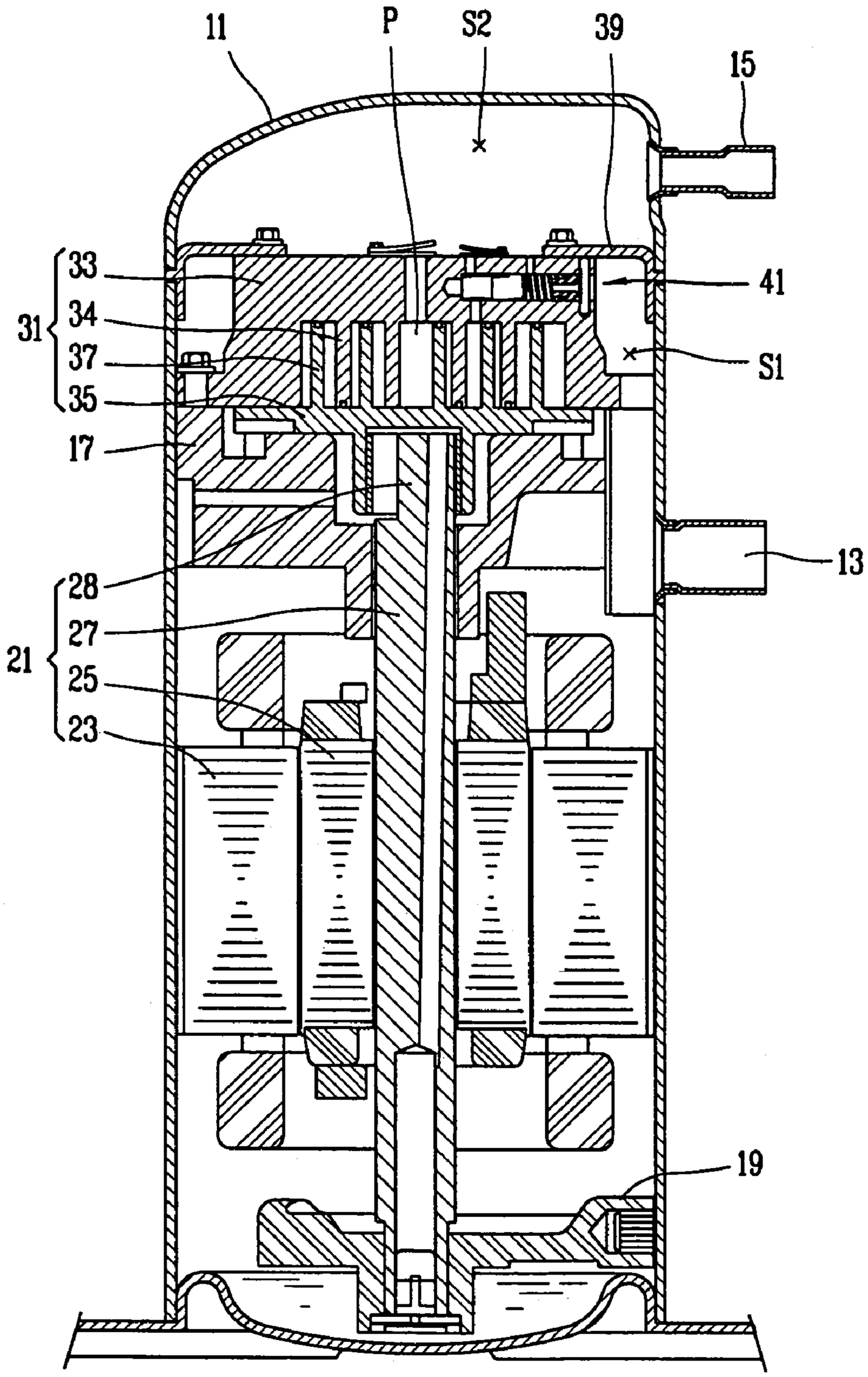


FIG. 2
CONVENTIONAL ART

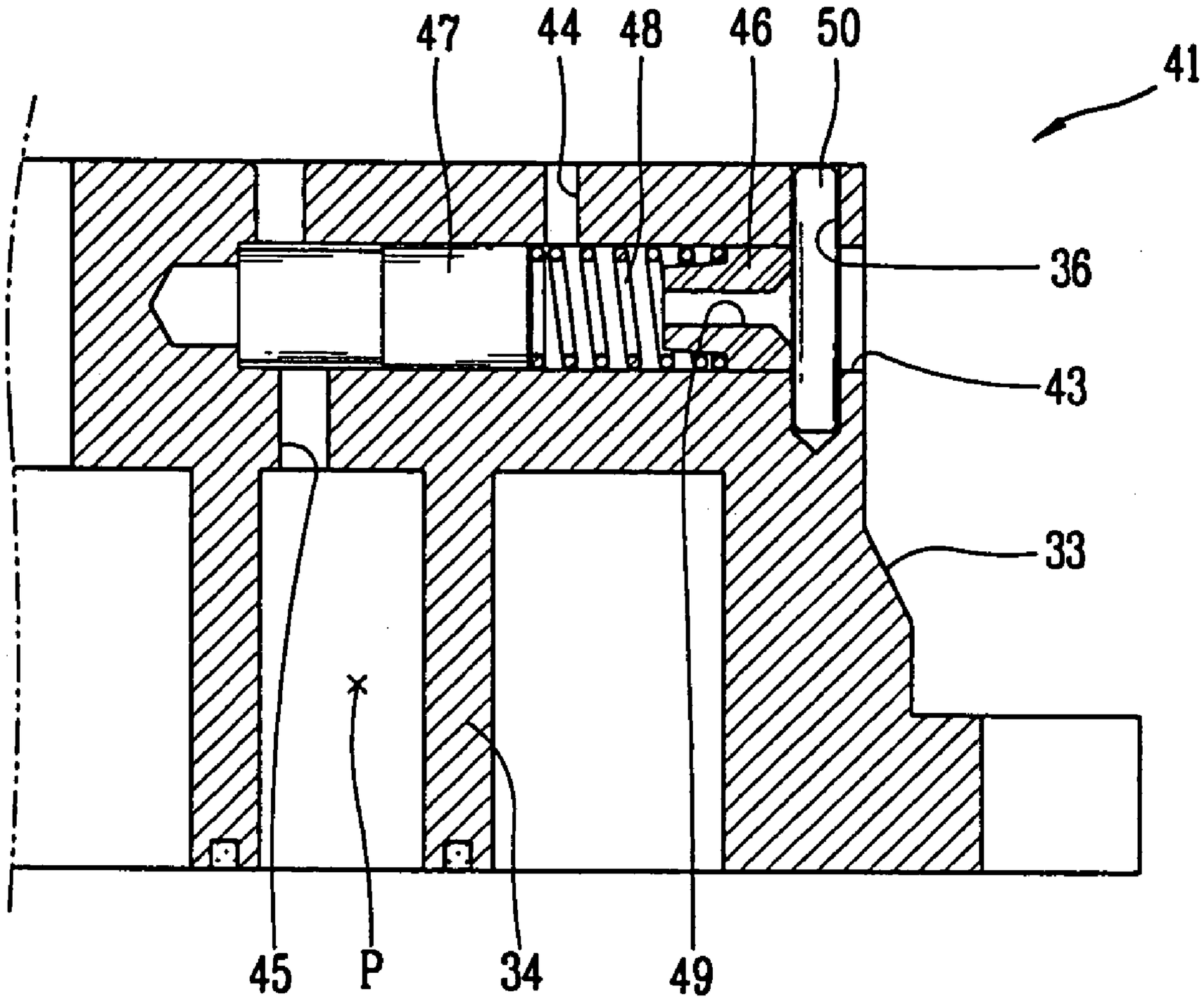
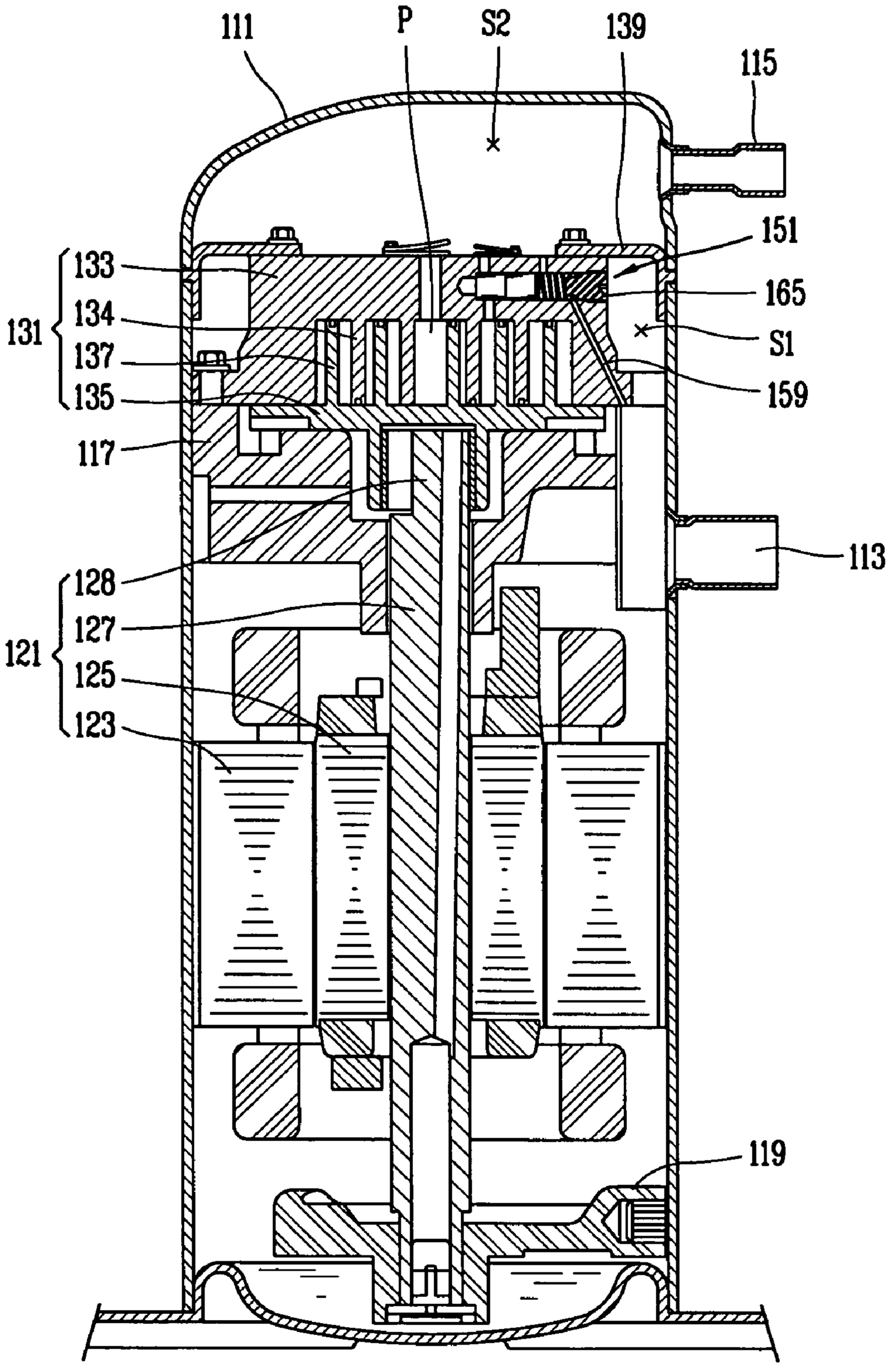


FIG. 3


111
P
S2
139
115
151
165
S1
159
133
134
137
135
131
117
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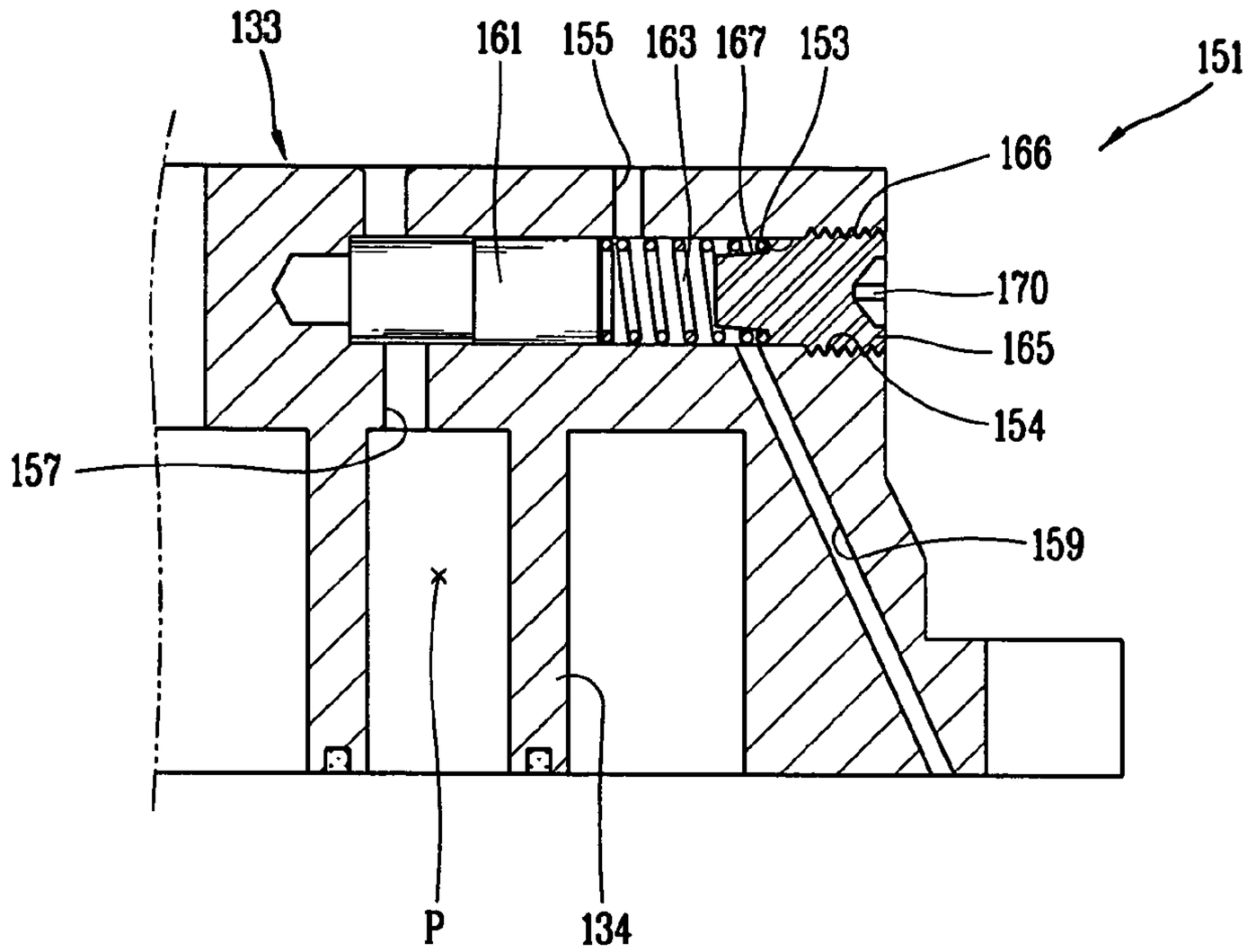
128
127
121
125
123
119

FIG. 4


133
161
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163
167
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151
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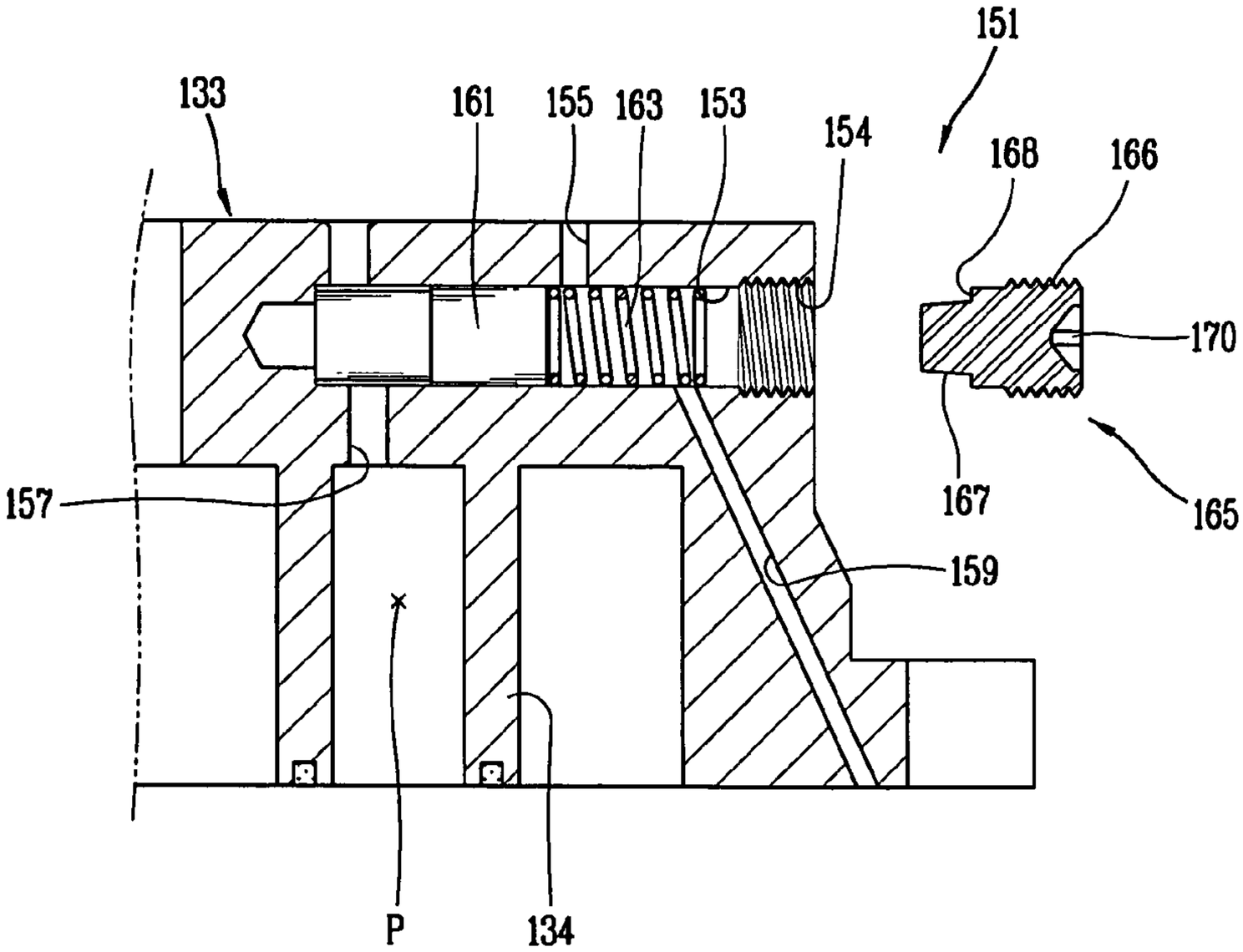
134

FIG. 5


151
133
161
155
163
153
154
168
166
170
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134

FIG. 6

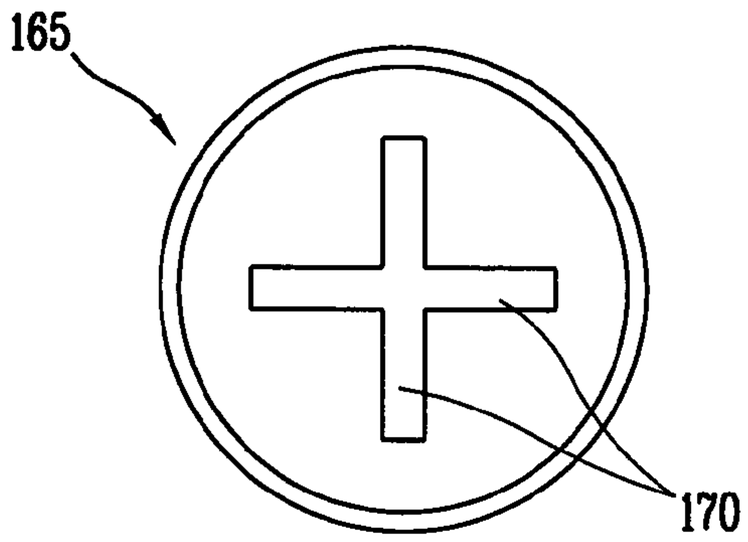
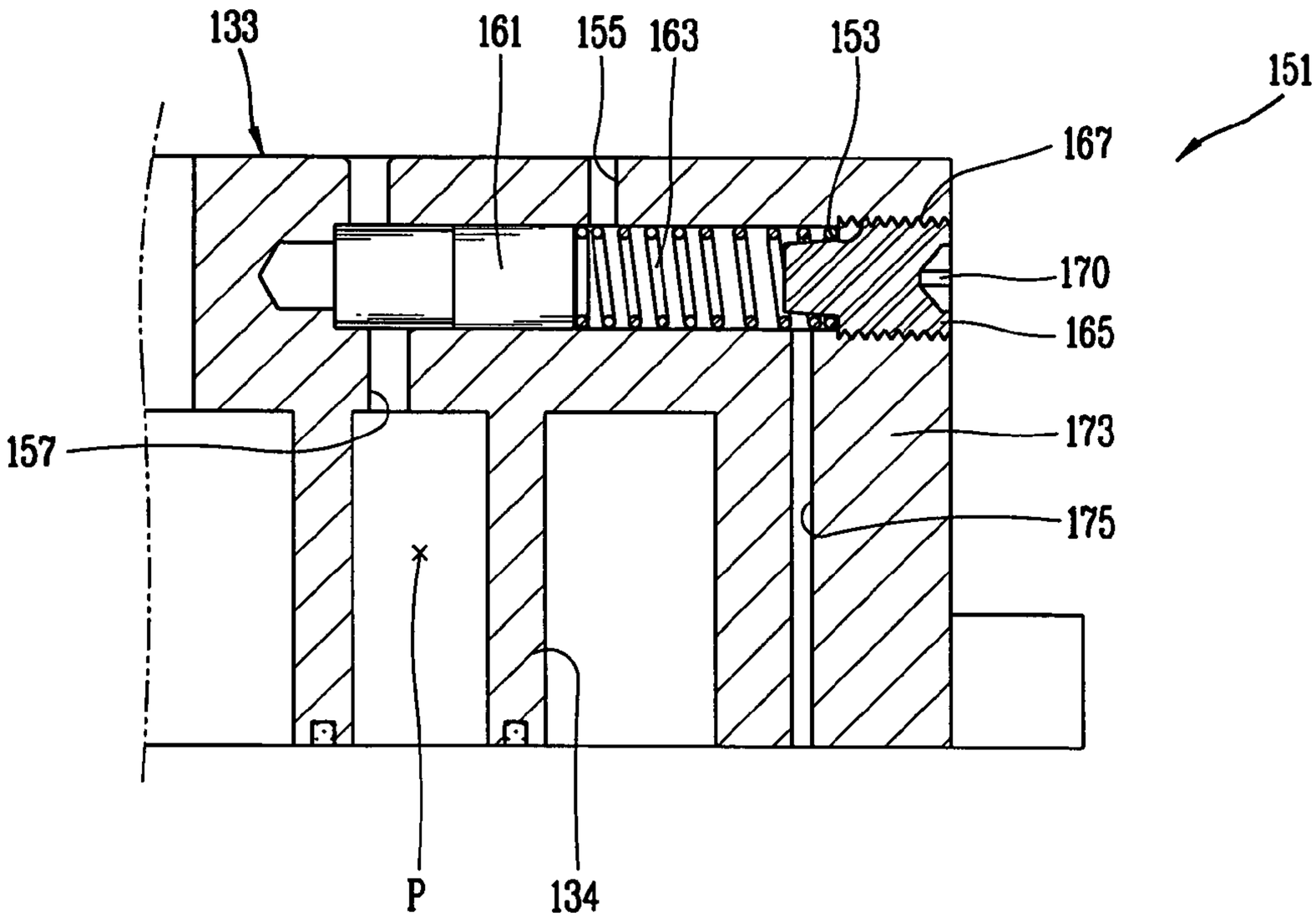


FIG. 7



SCROLL COMPRESSOR HAVING VACUUM PREVENTING STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a scroll compressor having a vacuum preventing structure, and more particularly, to a scroll compressor having a vacuum preventing structure capable of preventing a vacuum of the compressor by making a gas of a discharge pressure side backflow toward a suction pressure side during the abnormal operation such as the pump down or clogging of an expansion valve.

2. Description of the Background Art

In general, a compressor changes mechanical energy into latent energy of compression fluid, and is classified into a reciprocating type compressor, a scroll type compressor, a centrifugal type compressor and a vane type compressor.

Among them, unlike the reciprocating type compressor using linear reciprocation of an opening/closing member, the scroll type compressor sucks, compresses and discharges a gas by using a rotation body like the centrifugal type compressor or the vane type compressor.

FIG. **1** is a longitudinal sectional view showing the conventional scroll compressor, and FIG. **2** is an enlarged view showing an important part of FIG. **1**.

As shown therein, the conventional scroll compressor includes: a casing **11** forming a receiving space therein; a compression part **31** received and installed in the casing **11**, for compressing a refrigerant; and a motor part **21** for supplying a driving force to the compression part **31**.

A suction pipe **13** and a discharge pipe **15** for sucking and discharging a refrigerant is formed at one side of the casing **11**, and an upper frame **17** and a lower frame **19** are separately and vertically installed in the casing in order to support the compression part **31** and the motor part **21**.

The compression part **31** includes a fixed scroll **33** having a wrap **34** of an involute shape and fixedly installed at the upper frame **17** and an orbiting scroll **35** having a wrap **37** of an involute shape, coupled with the fixed scroll **33** to reciprocally form a compression space (S), and compressing a refrigerant while performing the relative motion with respect to the fixed scroll **33**.

A high/low pressure separation plate **39** for separating the inside of the casing **11** into a discharge pressure space (S**2**) and a suction pressure space (S**1**) is coupled with the fixed scroll **33**.

The motor part **21** includes a stator **23** fixedly installed in the casing **11** and a rotor **25** rotatably received and installed in the stator **23** on the basis of a rotary shaft **27** having an eccentric portion **28** at its one side.

Meanwhile, in case of the pump down or in case that an expansion valve is clogged, the suction pressure space (S**1**) becomes in a high vacuum. At this time, the constituting parts of the compressor can be damaged by fire or broken.

To prevent this problem, there is provided a vacuum preventing device **41** in the conventional art.

The vacuum preventing device **41** includes: a back pressure passage **43** formed at a predetermined depth along a radial direction from a side surface of the fixed scroll **33**; a discharge pressure hole **44** formed at an upper portion of the back pressure passage **43** to make the back pressure passage **43** communicate with the discharge pressure space (S**2**); a middle pressure hole **45** formed at a lower portion of the back pressure passage **53** to make the back pressure passage **43** communicate with the compression space (S); a piston **47** slidably received in the back pressure passage **43**, for opening or closing the discharge pressure hole **44**; a spring **48** for applying an elastic force at the piston **47** such that the piston **47** can move from its one side to a position where the piston **47** opens the discharge pressure hole **44**; a stopper **46** inserted into an inlet side of the back pressure passage **43**; and a fixing pin **50** for fixing the stopper **46** to prevent separation of the stopper **46**.

A suction pressure hole **49** for connecting the back pressure passage **43** with the suction pressure space (S**1**) is penetratingly formed at the center of the stopper **46**. A pin hole **36** for inserting and coupling the fixing pin **50** into the fixed scroll **33** is formed at the fixed scroll **33**.

However, in the conventional scroll compressor having such a construction, the piston and the spring are mounted in the back pressure and the stopper is fixed by inserting the fixing pin into the pin hole, thereby causing an assembly to be difficult. In addition, since the pin hole is positioned at an outer edge of the fixed scroll **33**, intensity around the pin hole is low and therefore the fixed scroll can be easily damaged.

In addition, a refrigerant gas in the discharge pressure space (S**2**) flows into the back pressure **53** through the discharge pressure hole **44**, and the refrigerant gas having flowed into the back pressure **53** flows into the suction pressure space (Si) through the suction pressure hole **49**. At this time, the high temperature refrigerant gas receives flow resistance, thereby stopping the driving of the motor part **21**. Accordingly, it takes relatively much time to release the vacuum of the scroll compressor.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a scroll compressor having a vacuum preventing structure providing easy assembly and capable of quickly and effectively preventing damage to parts during the abnormal operation.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a scroll compressor having a vacuum preventing structure comprising: a casing forming a receiving space therein; a fixed scroll fixed to a main frame installed in the casing, and including a back pressure passage at an outer side surface thereof, a discharge pressure hole formed at one side of the back pressure passage such that the back pressure passage and a discharge pressure space of the casing can communicate with each other, a middle pressure hole formed at another side of the back pressure passage such that the back pressure passage and a compression space of the casing can communicate with each other, and a suction pressure hole formed at still another side of the back pressure passage such that the back pressure passage and a suction pressure space can communicate with each other; an orbiting scroll positioned between the fixed scroll and the main frame and forming a compression space by being coupled with the fixed scroll; a piston slidably installed in the back pressure passage, for opening or closing the discharge pressure hole; an elastic member installed in the back pressure passage, for supporting the piston; and a stopper for closing an inlet of the back pressure passage.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. **1** is a longitudinal sectional view showing the conventional scroll compressor;

FIG. **2** is an enlarged view showing an important part of FIG. **1**;

FIG. **3** is a longitudinal sectional view showing a scroll compressor having a vacuum preventing structure in accordance with one embodiment of the present invention;

FIG. **4** is an enlarged view showing an important part of FIG. **3**;

FIG. **5** is a longitudinal sectional view showing a stopper coupled with a back pressure passage in the scroll compressor having the vacuum preventing structure in accordance with one embodiment of the present invention;

FIG. **6** is a side view showing the stopper in the scroll compressor having the vacuum preventing structure in accordance with one embodiment of the present invention; and

FIG. **7** is a longitudinal sectional view showing a scroll compressor having the vacuum preventing structure in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Hereinafter, a scroll compressor having a vacuum preventing structure in accordance with the present invention will be described, referring to the accompanying drawings.

FIG. **3** is a longitudinal sectional view showing a scroll compressor is having a vacuum preventing structure in accordance with one embodiment of the present invention, FIG. **4** is an enlarged view showing an important part of FIG. **3**, FIG. **5** is a longitudinal sectional view showing a stopper coupled with a back pressure passage in the scroll compressor having the vacuum preventing structure in accordance with one embodiment of the present invention, and FIG. **6** is a side view showing the stopper in the scroll compressor having the vacuum preventing structure in accordance with one embodiment of the present invention.

As shown therein, the scroll compressor having the vacuum preventing structure in accordance with one embodiment of the present invention includes: a casing **111** forming a hermetic receiving space therein; a compression part **131** received in the casing **111**, for compressing a refrigerant; and a motor part **121** for supplying a driving force to the compression part **131**. The motor part **121** includes a stator **123** fixedly installed in the casing **111** and a rotor **125** rotatably installed in the stator **123** on the basis of a rotary shaft **127** having an eccentric portion **128** at its one side.

The compression part **131** includes: a fixed scroll **133** having a wrap **134** of an involute shape and fixedly installed at an upper frame **117**, and an orbiting scroll **135** having a wrap **137** of an involute shape, coupled with the fixed scroll **133** to reciprocally form a compression space (P) of a refrigerant, having its lower portion coupled with the eccentric portion **128**, and compressing a refrigerant while performing the relative motion with respect to the fixed scroll **133**. A high/low pressure separation plate **139** for separating the inside of the casing **111** into a discharge pressure space (S**2**) and a suction pressure space (S**1**) is coupled with an upper surface of the fixed scroll **133**.

Meanwhile, a vacuum preventing device **151** for preventing the compression progress in a state that the inside of the casing **111** is vacuumized is installed at the fixed scroll **133**.

In the vacuum preventing device **151** of the scroll compressor in accordance with the present invention, a back flow passage **153** is formed at a side surface of the fixed scroll **133** at a predetermined depth, a discharge pressure hole **155** for making the back pressure passage **153** communicate with the discharge pressure space (S**2**) is formed at an upper portion of the back pressure passage **153**, a middle pressure hole **157** for making the back pressure passage **153** communicate with the compression space (P) is formed at one side of a lower portion of the back pressure passage **153**, and a suction pressure hole **159** for making the back pressure passage **153** communicate with the suction pressure space (S**1**) is formed at the other side of the back pressure passage **153**.

The back pressure passage **153** is formed in parallel with an upper surface of the fixed scroll **133**, and the suction pressure hole **159** is inclined with respect to the back pressure passage **153**.

A piston **161** is slidably installed in the back pressure passage **153** so as to selectively open or close the discharge pressure hole **155** during the abnormal operation such as the pump down or clogging of an expansion valve.

A stopper **165** for closing the back pressure passage **153** is installed at an inlet of the back pressure passage **153**, and a spring **163** is installed between the piston **161** and the stopper **165**.

One side of the spring **163** is fixed to the stopper **165**, and the other side of the spring **163** is fixed to the piston **161**.

The piston **161** closes the discharge pressure hole **155** during the normal operation, and the piston **161** moves only during the abnormal operation to connect the discharge pressure hole **155** with the suction pressure hole **159**.

A spring support portion **168** contacting with an end portion of the spring **163** and supporting the spring **163** is formed on an end portion of the insertion side of the stopper **165** inserted into the back pressure passage **153**. A guide portion **167** which protrudes from the spring support portion **168** with its diameter gradually decreasing along a longitudinal direction of the back pressure passage **153** is formed on one side of the spring support portion **168** in order that the end portion of the spring **163** can be guided to the spring support portion **168**.

A female screw portion **154** is formed on an inlet of the back pressure passage **153**, and a male screw portion **166** screw-coupled with the female screw portion **154** is formed on the stopper **165**. A tool insertion groove **170** having a cross shape is recessed on an exposed end portion of the stopper **165** which is exposed to the outside of the back pressure passage **153** such that a tool for turning the stopper **165**, such as a flat head screwdriver or a cross head screwdriver can fit into the tool insertion groove **170**. Here, the tool insertion groove **170** can be constructed as a wrench groove in order that a hexagonal wrench can be inserted thereinto.

In addition, a suction pressure hole **159** for connecting the back pressure passage **153** with the suction pressure space (S**1**) is penetratingly formed in the back pressure passage **153** such that a high temperature gas in the suction pressure

space (S2) can quickly flow toward the motor part **121** when the discharge pressure hole **155** is opened.

Meanwhile, FIG. **7** is a longitudinal sectional view showing a scroll compressor having a vacuum preventing structure in accordance with another embodiment of the present invention.

As shown in FIG. **7**, a thick wall portion **173** in which one part is thicker than the other part in the fixed scroll **133** is formed, and a suction pressure hole **175** perpendicular to the back pressure passage **153** can be formed at the thick wall portion **173**.

Hereinafter, the operation of the scroll compressor having the vacuum preventing structure in accordance with one embodiment of the present invention having a suction construction will be described with reference to FIGS. **3** to **5**.

When assembling the scroll compressor, a user can easily assemble the stopper **165** in the back pressure passage **153** by inserting the piston **161** and the spring **163** into the back pressure passage **153**, fitting a tool (not shown) into the tool insertion groove **170** of the stopper **165** in a state that the guide portion **167** of the stopper **165** is inserted in the back pressure passage **153**, and screw-coupling the stopper **165** in the back pressure passage **153** by turning the stopper **165**.

Meanwhile, in case of the normal operation of the compressor, while a refrigerant gas is sucked and compressed, by the action of pressure of the compression space (P), the piston **161** moves to a position where the discharge pressure hole **155** is closed. At this time, the spring **163** is compressed and accumulates an elastic force.

On the other hand, in case of the abnormal operation, in a state that the suction of the refrigerant into the casing **111** is stopped, the pressure of the compression space (S1) is reduced when the compression is performed, and by the elastic force of the spring **163**, the piston **161** moves to a position where the discharge pressure hole **155** is opened. Accordingly, the high temperature refrigerant gas existing in the discharge pressure space (S2) flows into the back pressure passage **153**, and the introduced high temperature refrigerant gas quickly flows toward the motor part **121** through the suction pressure hole **159**. When the high temperature refrigerant gas flows toward the motor part **121**, a device protecting against overload (not shown) is operated to thereby stop the driving of the motor part **121**, whereby the inside of the casing **111** is early prevented from being in a high vacuum and therefore damage by fire, deterioration and breakdown of the parts due to the vacuum operation can be effectively prevented.

As so far described, in accordance with the present invention, the stopper can be easily assembled in the back pressure passage without using the fixing pin, and the conventional problem that surroundings of the pin hole is fragile can be solved.

In addition, since a refrigerant gas of the discharge pressure space quickly flows to the suction pressure space through the suction pressure hole connected to the back pressure passage without resistance, damage by fire, deterioration and breakdown of the parts due to a high vacuum in the casing during the abnormal operation can be effectively prevented.

As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A scroll compressor having a vacuum preventing structure comprising:

a casing forming a receiving space therein;

a fixed scroll fixed to a main frame installed in the casing, and including a back pressure passage at an outer side surface thereof, a discharge pressure hole formed at an upper portion of the back pressure passage such that the back pressure passage and a discharge pressure space of the casing can communicate with each other, a middle pressure hole formed at a lower portion of the back pressure passage such that the back pressure passage and a compression space of the casing communicates with each other, and a suction pressure hole formed at the lower portion of the back pressure passage such that the back pressure passage and a suction pressure space communicates with each other;

an orbiting scroll positioned between the fixed scroll and the main frame and forming a compression space by being coupled with the fixed scroll;

a piston slidably installed in the back pressure passage, for opening or closing the discharge pressure hole;

an elastic member installed in the back pressure passage, for supporting the piston; and

a stopper for closing the back pressure passage installed at an inlet of the back pressure passage.

2. The scroll compressor having a vacuum preventing structure of claim **1**, wherein the back pressure passage has a longitudinal axis that is formed in parallel with an upper surface of the fixed scroll.

3. The scroll compressor having a vacuum preventing structure of claim **1**, wherein the suction pressure hole is inclined with respect to the back pressure passage.

4. The scroll compressor having a vacuum preventing structure of claim **1**, wherein the suction pressure hole is perpendicular to the back pressure passage.

5. The scroll compressor having a vacuum preventing structure of claim **1**, wherein a female screw is formed on an inner circumferential surface of an inlet the back pressure passage, and correspondingly a male screw is formed on an outer circumferential surface of the stopper.

6. The scroll compressor having a vacuum preventing structure of claim **1**, wherein a guide portion is formed on an end of the stopper.

7. The scroll compressor having a vacuum preventing structure of claim **1**, wherein a tool insertion groove is formed on an end of the stopper.

8. A scroll compressor having a vacuum preventing structure comprising:

a casing forming a receiving space therein;

a fixed scroll fixed to a main flame installed in the casing, and including a back pressure passage at an outer side surface thereof, a discharge pressure hole formed at an upper portion of the back pressure passage such that the back pressure passage and a discharge pressure space of the casing communicates with each other, and a middle pressure hole formed at a lower portion of the back pressure passage such that the back pressure passage and a compression space of the casing communicates with each other;

an orbiting scroll positioned between the fixed scroll and the main frame and forming a compression space by being coupled with the fixed scroll;

a piston slidably installed in the back pressure passage, for opening or closing the discharge pressure hole;

an elastic member installed in the back pressure passage, for supporting the piston; and

a threaded stopper for closing the back pressure passage at an inlet located at the outer side surface of the back pressure passage.

9. The scroll compressor having a vacuum preventing structure of claim **8**, wherein the back pressure passage has a longitudinal axis that is formed in parallel with an upper surface of the fixed scroll.

10. The scroll compressor having a vacuum preventing structure of claim **9**, further comprising a suction pressure hole which is inclined with respect to the back pressure passage.

11. The scroll compressor having a vacuum preventing structure of claim **9**, further comprising a suction pressure hole which is perpendicular to the back pressure passage.

12. The scroll compressor having a vacuum preventing structure of claim **8**, wherein a female screw is formed on an inner circumferential surface of an inlet of the back pressure passage, and correspondingly a male screw is formed on an outer circumferential surface of the stopper.

13. The scroll compressor having a vacuum preventing structure of claim **8**, wherein a guide portion is formed on an end of the stopper.

14. The scroll compressor having a vacuum preventing structure of claim **8**, wherein a tool insertion groove is formed on an end of the stopper.

15. The scroll compressor having a vacuum preventing structure of claim **8**, wherein a suction pressure hole is formed at still another side of the back pressure passage such that the back pressure passage and a suction pressure space of the casing can communicate with each other.

16. A scroll compressor having a vacuum preventing structure comprising:

a casing forming a receiving space therein;

a fixed scroll fixed to a main frame installed in the casing, and including a back pressure passage having first and second end portions and side portions at an outer side surface of the fixed scroll, a discharge pressure hole formed at one side portion of the back pressure passage such that the back pressure passage and a discharge pressure space of the casing can communicate with each other, a middle pressure hole formed at another side portion of the back pressure passage such that the back pressure passage and a compression space of the casing communicates with each other, and a suction pressure hole formed at still another side portion of the back pressure passage such that the back pressure passage and a suction pressure space communicates with each other;

an orbiting scroll positioned between the fixed scroll and the main flame and forming a compression space by being coupled with the fixed scroll;

a piston slidably installed in the back pressure passage, for opening or closing the discharge pressure hole;

an elastic member installed in the back pressure passage, for supporting the piston; and

a threaded stopper installed at an inlet of the back pressure passage for closing one end of the back pressure passage.

17. A scroll compressor having a vacuum preventing structure comprising:

a casing forming a receiving space therein;

a fixed scroll fixed to a main frame installed in the casing, and including a back pressure passage having first and second end portions and side portions and being located within and adjacent to an outer side surface thereof, a discharge pressure hole formed at one side portion of the back pressure passage such that the back pressure passage and a discharge pressure space of the casing communicates with each other, and a middle pressure hole formed at another side portion of the back pressure passage such that the back pressure passage and a compression space of the casing communicates with each other;

an orbiting scroll positioned between the fixed scroll and the main frame and forming a compression space by being coupled with the fixed scroll;

a piston slidably installed in the back pressure passage, for opening or closing the discharge pressure hole;

an elastic member installed in the back pressure passage, for supporting the piston; and

a threaded stopper installed at an inlet of the back pressure passage for closing an end portion of the back passage.

* * * * *